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"TO DEVELOP A RADON GAS MONITOR OPERATING ON A CONTINUOUS BASIS AND HAVING A MEMORY STORAGE AND DATA PROCESSING CAPABILITIES"

RGA-45

TSIVOG.BAS PROGRAM

EDA INSTRUMENTS INC.

(Revision 1.01)

10pp

MICROMEDIA

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The program TSIVOG.BAS when running on a Radio Shack Model 102 allows an operator to control the RGA-45 so that it is possible to:-

a)pump for a period of time
b)delay for a period of time
c)count for a period of time

This enables the Model 102 to 'force' the RGA-45 to operate in a 'pseudo-discrete' as opposed to the normal continuous mode of operation. This mode is verv useful for an operator who desires to use the Modified Tsivoglou, or similiar methods in the analysis of radio-active daughter decay.

NOTE THAT THE MODEL 102 IS ACTING AS A CONTROLLER TO THE RGA-45 AND THEREFORE THE MODEL 102 AND THE RGA-45 MUST BE PERMANENTLY CONNECTED TOGETHER. YOU CANNOT PROGRAM THE RGA-45 WITH THE PROGRAM AND THEN DISCONNECT THE MODEL 102

The operation of the program TSIVOG.BAS is on a question/answer format where in order to progress to the next question the current question must first be answered.

Load the program into the Model 102. For information on how to load the program either consult the Model 102 Operators Manual or else the RGA-45 Operators Manual.

Type RUN followed by pressing the ENTER key.

The following will appear on the display with R.RR replaced by the actual Version number of the TSIVOG.BAS program.

WORKING LEVEL CALCULATION
USING THE MODIFIED TSIVOGLOU METHOD

VERSION R.RR
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After a short period the following appears:-

```
1)CONNECT RGA-45 TO MODEL 102
2)INSTALL NEW FILTER IN RGA-45?
3)TURN ON RGA-45
  (FRONT PANEL SWITCH TO ON POSITION)

$$$PRESS ANY KEY WHEN READY$$$
PRESS "ESC" KEY TO EXIT PROGRAM
```

Install a new filter if so desired.

Front Panel switch marked 'AUTO OFF ON' must be set to the ON position.

Pressing the ESC key will return to Model 102 Operating System level, pressing any other key and the Model 102 will attempt to establish the communication link with the RGA-45 and display the following.

```
ATTEMPTING TO ESTABLISH LINK
```

If unsuccessful after three attempts the Model 102 will briefly display the following before reverting back to the previous display.

```
ATTEMPTING TO ESTABLISH LINK
   CANNOT ESTABLISH LINK
```

If successful the current RGA-45 date and time will be displayed and request whether this is correct. If it is press the ENTER key only. If incorrect press any other key.

```
CURRENT RGA-45 DATE IS 09/25/86
                TIME IS 12:05:32
ENTER KEY ONLY IF CORRECT
ELSE PRESS ANY KEY
```

If the current RGA-45 time is incorrect the following will be displayed. The new date and time must be entered in the correct format with a SPACE between the YY (year) parameter and the HH (hour) parameter.

```
CURRENT RGA-45 DATE IS 09/25/86
              TIME IS 12:05:32
ENTER KEY ONLY IF CORRECT
ELSE PRESS ANY KEY
ENTER DATE AND TIME IN EXACT FORMAT
MM/DD/YY HH:MM:SS
? []
```

The new date and time will be programmed into the RGA-45 and will then be read back and displayed to ensure that it is correct. If it is now press the ENTER key.
Note that it takes a finite amount of time to perform this operation and therefore the seconds and/or minutes will invariably have changed.

```
CURRENT RGA-45 DATE IS 09/25/86
              TIME IS 12:25:32
ENTER KEY ONLY IF CORRECT
ELSE PRESS ANY KEY
```

The program then requests the time to start data gathering. This is only in hours (HH) and minutes (MM) and must be in the 24 hour clock format. As no request is made for months, days or years the assumption is that the operator entered start time is later than the current time. If it is not then the program will not begin to gather data until the next day. That is, this program does not support an operator programmed START TIME in the future.

```
CURRENT RGA-45 DATE IS 09/25/86
              TIME IS 12:25:32
ENTER KEY ONLY IF CORRECT
ELSE PRESS ANY KEY
ENTER TIME TO START (HH:MM) ? []
```

The program then requests whether it will perform one 'grab' sample or whether it will perform 'continuous' samples. If you enter G for grab sample then only one (1) complete controlling sequence will occur. If on the other hand you enter C for continuous the system will repeat the controlling sequence until the memory in the RGA-45 is full.

```
GRAB OR CONTINUOUS SAMPLING
PRESS G OR C KEY
```

The program then displays the current controlling sequence (if any). The principle is as follows:-

a) the system will sample the air (pump on sequence) for X minutes. No counting of activity takes place during this time period.

b) at the end of the pump on period the system will delay for A minutes. Again no counting of activity takes place.

c) at the end of the delay period the system will count the activity for a period of AA minutes. At the end of this period this data is read by the Model 102 and stored for calculation when the entire controlling sequence is finished. Note that this data is also stored internally within the RGA-45 and could at a later date be read for post-processing.

d) this delay/count sequence is performed a second time using a delay of B minutes and a count time of BB minutes.

e) this delay/count sequence is performed a third time using a delay of C minutes and a count time of CC minutes.

f) after all the delay/count sequences the operator may wait a period of time (Y minutes) before starting the entire sequence again. Note of course that if the operator has selected grab sampling then this wait period is meaningless.

THE MODEL 102 IS NOT A HIGH SPEED COMPUTER AND SUBSEQUENTLY IT CAN TAKE SEVERAL SECONDS FOR THE MODEL 102 TO READ THE LAST COUNT AND PERFORM THE CALCULATIONS. ONLY AFTER DOING THIS WILL IT BEGIN THE SEQUENCE AGAIN AND THEREFORE THE BEGINNING OF THE PUMP ON PERIOD WILL BE DELAYED. A WAIT OF A MINIMUM OF 1 MINUTE IS SUGGESTED TO AVOID THIS TIMING PROBLEM

```
SAMPLE AT 1  L/M FOR X MINUTES
DELAY FOR A     THEN COUNT FOR AA
DELAY FOR B     THEN COUNT FOR BB
DELAY FOR C     THEN COUNT FOR CC
DELAY BETWEEN READINGS Y
    TOTAL SAMPLE TIME Z MINUTES
PRESS ENTER ONLY IF CORRECT
```

If the current controlling sequence is incorrect then press any key other than the ENTER key and the program will prompt for the changes required. The sequence is stored ir a

file called ZIGPAR.DO in the Model 102 and thus is available for later recall.

Enter the new pump on period. Simply pressing the ENTER key means that the current value is correct.

```
ENTER ALL TIME PERIODS IN MINUTES

ENTER INITIAL PUMP ON PERIOD
(NO COUNTING PERIOD) ? [1]
```

Likewise enter the new delay 1 period. The current value is displayed in brackets and if correct simply press ENTER.

```
ENTER DELAY PERIOD 1  (A)? [1]
```

Enter the new count 1 period or simply press ENTER if correct.

```
ENTER DELAY PERIOD 1  (A)? [1]

ENTER COUNT PERIOD 1  (AA)? [1]
```

The above sequence repeats for the second and third delay/count periods.

Finally the program requests the time period to wait after the third and last counting period before beginning the sequence again.

```
DELAY IN MINUTES BETWEEN READINGS

ENTER KEY ONLY FOR NO DELAY
ELSE ENTER DELAY PERIOD? [1]
```

The program then displays the new time periods.

Note that the TOTAL SAMPLE TIME is derived from the sum of the pump on period and all the delay and counting periods. It does not include the DELAY BETWEEN READINGS value. That is if the start time is 12:00 the system is programmed in continuous mode the next sequence will begin in Y+Z minutes.

```
SAMPLE AT 1  L/M FOR X MINUTES
DELAY FOR A     THEN COUNT FOR AA
DELAY FOR B     THEN COUNT FOR BB
DELAY FOR C     THEN COUNT FOR CC
DELAY BETWEEN READINGS Y
    TOTAL SAMPLE TIME Z MINUTES
PRESS ENTER ONLY IF CORRECT
```

The program then asks whether to erase the current data records currently stored in the RGA-45. Also displayed is the current percentage usage of memory. Press the Y key to erase, any other key and the new data will be stored in the RGA-45 after the current data.

```
    ERASE CURRENT RGA-45 DATA RECORDS ?

CURRENT MEMORY USAGE 888%
ENTER Y TO ERASE
ELSE ENTER OTHER KEY
```

The program then requests where to store the data.

If you wish to store the data on tape then enter the complete word TAPE followed by pressing the ENTER key. You must have a compatible tape recorder connected and correctly set up. See either the Model 102 Operators Manual or the RGA-45 Operators Manual for details on correct connections and switch positions.

If you wish to have the data printed then enter PRINT and press the ENTER key. If you do this without a printer connected to the Model 102 and not ON LINE the Model 102 will hang up.

NOTE however that no matter what output you select the data will always be stored in the RGA-45 and would be available for later recall.

```
ENTER "TAPE" TO SAVE RESULTS
ENTER "PRINT" TO PRINT RESULTS

ANYTHING ELSE DISPLAYS RESULTS ONLY
(CONNECT TAPE OR PRINTER IF SELECTED)
? []
```

The program then confirms the output selected.

```
DATA OUTPUT TO TAPE
PRESS ENTER IF CORRECT
```

and if it is to a tape recorder will ask for a file name. This file name is limited to six (6) characters of which the first must be alphabetic.

```
ENTER TAPE FILE NAME ? :)
```

All information to run the program has now been entered and the display updates to the operation display.

The SAMPLE PERIOD line shows both the total number of minutes in the entire sequence (excluding any programmed wait period at the end of the sequence) and the number of minutes remaining in the sequence. Until the sequence actually starts this line will not change.

Other information displayed shows the a continually updating current time (first line), the next interval start time (second line), the current MEMory usage in percent in the RGA-45 (seventh line) and the output device (eighth line) here shown as DISPLAY.

```
DATE  09/25/86 TIME 12:29:17
INTERVAL START TIME 12:30
SAMPLE PERIOD ### MINUTES ### REMAINING


RaA =             RaB =
RaC =             (pCi/l)     MEM ###%
WORKING LEVEL (WNL) =         DISPLAY
```

When the sequence starts a new line (fourth line) is displayed which shows the current phase of the sequence (SAMPLE), how long this phase is and how many minutes are remaining.

```
DATE  09/25/86 TIME 12:30:17
INTERVAL START TIME 12:30
SAMPLE PERIOD ### MINUTES ### REMAINING
SAMPLE FOR    10 MINUTES  10 REMAINING

RaA =             RaB =
RaC =             (pCi/l)     MEM ###%
WORKING LEVEL (WNL) =         DISPLAY
```

This pattern of displaying the current phase of the sequence continues with the DELAY and COUNT and if programmed WAIT. The number 1 following the word DELAY shows that this is the first delay sequence.

```
DATE  09/25/86 TIME 12:41:17
INTERVAL START TIME 12:30
SAMPLE PERIOD ### MINUTES ### REMAINING
DELAY 1 FOR     2 MINUTES   1 REMAINING

RaA =             RaB =
RaC =             (pCi/l)     MEM ###%
WORKING LEVEL (MWL) =         DISPLAY
```

Below is an example of COUNT 1 phase of the sequence.

```
DATE  09/25/86 TIME 12:43:17
INTERVAL START TIME 12:30
SAMPLE PERIOD ### MINUTES ### REMAINING
COUNT 1 FOR     4 MINUTES   3 REMAINING

RaA =             RaB =
RaC =             (pCi/l)     MEM ###%
WORKING LEVEL (MWL) =         DISPLAY
```

At the end of the entire sequence the calculations are performed and the results for the three daughters and the computed Working Level is displayed.

ADDITIONAL KEYBOARD FUNCTIONS

There are three keyboard functions available whilst the system is running. These are:-

a) HARDCOPY PRINT OF CURRENT DISPLAY
   Whilst holding down the "CODE" key press the "/" key. If you do this without a printer connected the Model 102 will hang up.

b) STOP AT END OF CURRENT SEQUENCE
   Whilst holding down the "CODE" and "SHIFT" keys press the key marked "+="

c) STOP NOW
   Whilst holding down the "CODE" and "SHIFT" keys press the key marked "!1". This action will terminate the sequence immediately without any regard for where the program currently is in the sequence.

TSIVOGLOU CALCULATIONS

The calculations performed reside in the TSIVOG.BAS program starting at line number 6000.

Currently the calculations are :-

```
RaA = (1/(VL*CE)) * ( 0.16894*SC(1) - 0.82*SC(2) + 0.7753*SC(3) )

RaB = (1/(VL*CE)) * ( 0.00122*SC(1) - 0.02057*SC(2) + 0.04909*SC(3) )

RaC = (1/(VL*CE)) * ( - 0.02252*SC(1) + 0.03318*SC(2) - 0.03771*SC(3) )

MWL = (1/(VL*CE)) * ( 0.0961*SC(1) - 0.0650*SC(2) + 0.1881*SC(3) )
```

where

VL = volumetric sampling rate in litres/minute (1)
CE = counting efficiency (decimal fraction). Currently set to .2 but must be determined by analysis.
SC(n) = alpha counts for count periods 1, 2 and 3.

RGA-45 COMPATIBILITY

This program does direct access to various memory locations within the RGA-45. This requires the use of several alpha-numeric stings which are stored in the program starting at line 7000. These alpha-numeric strings must not be modified in any way whatsoever otherwise operation of the RGA-45 could be seriously degraded. However if changes are made to the program within the RGA-45 it may be necessary to change these strings. If this occurs a tape will be supplied with the necessary modifications stored in a file called STRING.BAS. In order to update the TSIVOG.BAS program it will be necessary to append this new file. This is done in the following manner:-

a) load the TSIVOG.BAS program into the Model 102 under BASIC (if not already resident within BASIC).
b) connect a tape recorder with switches and cable set correctly for play back to the Model 102. The Model 102 Operators Manual describes the procedure.
c) Insert the tape cassettte.
d) On the model 102 type the following exactly as shown

```
MERGE "CAS:STRING"
```

followed by pressing the ENTER key.
e) Save the new version of the program by typing the following exactly as shown

```
SAVE "TSIVOG.BAS",A
```